~~4~~10 Rec'd PCT/PTO 28 JUN 2000

FORM PTO-1390 REV. 5-93 US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE **TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371**		ATTORNEYS DOCKET NUMBER **P00,1316** U.S.APPLICATION NO. (if known, see 37 CFR 1.5) **09/582555**
INTERNATIONAL APPLICATION NO. **PCT/DE99/00052**	INTERNATIONAL FILING DATE **15 January 1999**	PRIORITY DATE CLAIMED **16 January 1998**

TITLE OF INVENTION
METHOD FOR CALIBRATING AN ENGRAVING AMPLIFIER

APPLICANT(S) FOR DO/EO/US
Ernst-Rudolf Gottfried Weidlich

Applicant herewith submits to the United States /Designated/Elected Office (DO/EO/US) the following items and other information:

1. ■ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. □ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ■ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ■ A proper Demand for International Preliminary Examination will be made by the 19th month from the earliest claimed priority date.
5. ■ A copy of International Application as filed (35 U.S.C. 371(c)(2))
   a. ■ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. □ has been transmitted by the International Bureau.
   c. □ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ■ A translation of the International Application into English (35 U.S.C. 371(c)(2).
7. ■ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. □ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. □ have been transmitted by the International Bureau.
   c. □ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ■ have not been made and will not be made.
8. □ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ■ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). **Unexecuted**
10. ■ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ■ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report).**
12. □ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ■ A FIRST preliminary amendment.
   □ A SECOND or SUBSEQUENT preliminary amendment.
14. □ A substitute specification.
15. □ A change of power of attorney and/or address letter.
16. ■ Other items or information:
   a. ■ Submission of Drawings - **One sheet of Drawing - Submission of Corrected Drawings**
   b. ■ **EXPRESS MAIL #EL568800229US dated June 28, 2000.**

430 Rec'd PCT/PTO 28 JUN 2000

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5) 09/582555	INTERNATIONAL APPLICATION NO. PCT/DE99/00052	ATTORNEY'S DOCKET NUMBER P00,1316

BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO .... $840.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) .. $670.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) .... $760.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO .... $970.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) .... $ 96.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				$840.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).				$ 0	
Claims	Number Filed		Number Extra	Rate	
Total Claims	9	- 20 =	47	X $ 18.00	$840.00
Independent Claims	2	- 3 =	0	X $ 78.00	$0
Multiple Dependent Claims				$260.00+	$
TOTAL OF ABOVE CALCULATIONS =					$
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$
SUBTOTAL =					$
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$
TOTAL NATIONAL FEE =					$840.00
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +					
TOTAL FEES ENCLOSED =					$840.00
				Amount to be refunded	$
				charged	$

a. ■ A check in the amount of $ 840.00 to cover the above fees is enclosed.
b. ☐ Please charge my Deposit Account No. ________ in the amount of $ ________ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. ■ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 08-2290. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Hill & Simpson
A Professional Corporation
85th Floor Sears Tower
Chicago, Illinois 60606

[signature]
SIGNATURE

Brett A. Valiquet
NAME

27,841
Registration Number

BOX PCT

IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANT: **ERNST-RUDOLF GOTTFRIED WEIDLICH**

DOCKET NO: P00,1316

SERIAL NO: GROUP ART UNIT:

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE99/00052
INTERNATIONAL FILING DATE: 15 January 1999
INVENTION: **"METHOD FOR CALIBRATING AN ENGRAVING AMPLIFIER"**

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

As a Preliminary Amendment for entry into the National Stage for the above-identified PCT application, the following is submitted:

IN THE DRAWINGS:

Please amend the drawing figure as indicated in the attached Submission of Corrected Drawings.

<u>IN THE SPECIFICATION</u>:

Please amend the specification as follows - all amendments are referenced to the translation enclosed the PCT application of the substitute pages in the PCT prosecution:

On page 1, before the title, insert

--S P E C I F I C A T I O N

TITLE--;

after the title, as a separate line, insert

--<u>BACKGROUND OF THE INVENTION</u>--.

On page 1, at line 6, after "as" insert --a--.

On page 1, at line 16, delete "To this end" and substitute --For this purpose--.

On page 1, at line 1, delete "relations" and substitute --relationships--.

On page 1, before line 22, insert the following title:

--<u>SUMMARY OF THE INVENTION</u>--.

On page 1, at line 22, delete "the" and substitute --an--.

On page 1, at line 24, after "calibration" insert --, and to guarantee an automatic and optional course of calibration to the greatest extent possible, without knowledge of the individual transmission functions and marginal conditions.--

On page 1, delete line 25, and substitute the following:

--According to the present invention, a method is provided for calibrating an engraving amplifier in an electronic engraving machine for engraving printing cylinders for gravure printing. An engraving signal for actuating an engraving stylus of an engraving member is acquired from engraving values representing desired tone values and a periodic vibration signal in an engraving amplifier that can be adjusted by signal values for generating an engraving raster. With the engraving stylus, cells are engraved into the printing cylinder, the actual dimensions of the cells representing engraved actual tone values. Transmission functions are calculated which reproduce relationships between variations, which are adjusted at the engraving amplifier, of the signal values, and the resulting variations of the geometric actual dimensions of the engraved cells. Signal values for modifying at least one parameter "vibration", "light", "depth", or "medium gradation" are set at the engraving amplifier. With the signal values, test cells are engraved for predetermined desired tone values, and their geometric actual dimensions are measured. Difference values are calculated from the actual dimensions and the desired dimensions of the cells upon consideration of the transmission functions. The signal values are corrected by adding the difference values. The steps of setting the signal values through correcting the signal values are repeated using the corrected signal values until the actual dimensions of the cells are at least within a tolerance range about the desired dimensions. To shorten the calibration time, in each sequence of the steps from setting the signal values through the correcting of the signal values, the actual dimensions of the cells are compared to the desired dimensions. If the actual dimensions are outside the tolerance range, transmission functions are recalculated. The difference values are computed upon consideration of the recalculated transmission functions. The signal values are corrected using the new difference values.--

On page 2, delete lines 26 and 27 insert the following heading:

--<u>BRIEF DESCRIPTION OF THE DRAWING</u>

The drawing figure is a block diagram of a preferred embodiment of the electronic engraving machine of the invention.

<u>DESCRIPTION OF THE PREFERRED EMBODIMENTS</u>--.

On page 3, at line 5, before “cutting” insert --a--.

On page 3, at lines 3-9, delete “( )”.

On page 3, at line 11, delete “( )”.

On page 3, at lines 13 and 14, delete “( )”.

On page 3, at line 18, delete “( )”.

On page 3, at lines 22-24, delete “( )”.

On page 3, at line 28, delete “( )”.

On page 4, at lines 1-5, delete “( )”.

On page 4, at line 6, delete “(14)’ and substitute --14--.

On page 4, at lines 7-11, delete “( )”.

On page 4, at line 17, delete “( )”.

On page 4, at lines 19-21, delete “( )”.

On page 4, at line 21, delete “out”.

On page 4, at lines 23-27, delete “( )”.

On page 4, at the last line, delete "( )".

On page 5, at lines 1 and 2, delete "( )".

On page 5, at line 5, delete "( )".

On page 5, at line 6, delete "so".

On page 5, at line 7, before "that" insert --so--.

On page 5, at lines 7 and 8, delete "( )".

On page 5, at line 13, delete "inventive", after "calibration" insert --of the invention--.

On page 5, at line 14, delete "consists of" and substitute --comprises--.

On page 5, at line 15, delete "consist" and substitute --comprises--.

On page 6, at line 4, delete "inputted" and substitute --input--.

On page 6, at line 5, delete "whereby" and substitute --where--.

On page 6, at line 15, delete "inputted" and substitute --input--.

On page 6, at line 16, delete "fetches" and substitute --calls--.

On page 6, at line 21, delete "fetched" and substitute --called--.

On page 6, at line 22, delete "( )".

On page 6, at line 23, delete "(30)" and substitute --30--.

On page 6, at line 24, delete "( )".

On page 6, at line 25, delete "( )".

On page 6, second line from the bottom, delete "( )".

On page 6, the last line, delete "( )".

On page 7, at lines 2-4, delete "( )".

On page 8, at line 3, delete "relations" and substitute --relationships--.

On page 8, at line 9, delete "relation" and substitute --relationship--.

On page 8, at line 27, delete "relation" and substitute --relationship--.

On page 9, at lines 2, 4 and 6, delete "relations" and substitute --relationships--.

On page 9, at line 11, delete "( )".

On page 9, at line 11, before "stored" insert --are--.

On page 9, at line 14, delete "[E] [sic]" and substitute --[F]--, insert --,-- before "a".

On page 9, at line 19, delete "relation" and substitute --relationship--.

On page 9, second to the last line, delete "( )".

On page 10, at lines 2, 8 and 11, delete "fictive" and substitute --fictional--.

On page 10, at line 23, delete "( )".

On page 10, at line 26, delete "fictive" and substitute --fictional--.

On page 11, at line 2, delete "fictive" and substitute --fictional--.

On page 11, at line 17, delete "( )".

On page 11, at line 20, delete "fictive" and substitute --fictional--.

On page 11, at line 27, delete "fictive" and substitute --fictional--.

On page 12, at line 1, delete "fictive" and substitute --fictional--.

On page 12, at line 13, delete "( )".

On page 12, at line 19, delete "as an advantageous development".

On page 12, at line 22, delete "is [sic]" and substitute --are--.

On page 13, as the last paragraph, insert the following paragraph:

--Although various minor changes and modifications might be proposed by those skilled in the art, it will be understood that my wish is to include within the claims of the patent warranted hereon all such changes and modifications as reasonably come within my contribution to the art.--

IN THE ABSTRACT:

Please add the following new Abstract:

--In a method for calibrating an engraving amplifier in an electronic engraving machine, whereby a vibration signal is used to control the engraving of an engraving element by using engraving tone values representing desired tone values ranging from "light" to "dark", small cup shapes are engraved. The dimensions of the cup shapes define the real tone values. Transmission functions are initially determined, reproducing correlations between signal values that are adjusted in the engraving amplifier and the resulting changes in the real dimensions of the cup shapes. Sample cup shapes are engraved for predetermined desired tone values using the adjusted signal values for at least one of the parameters such as “vibration”, “light”, “dark” or “mid tone”. Differential values are obtained from real measured dimensions and the predetermined desired dimensions of the sample cup shapes, taking into account the transmission functions, whereby the differential values are used to correct the adjusted signal values. Operations are repeated using the corrected signal values until the real dimensions of the engraved cup shapes correspond to at least a permissible variation of the desired dimensions.--

IN THE CLAIMS:

On page 14 of the claims, line 1, please change "Patent Claims" to --**I CLAIM AS MY INVENTION**--.

Please cancel claims 1-9 without prejudice.

Please substitute claims 10-18 as follows:

10. A method for calibrating an engraving amplifier in an electronic engraving machine for engraving printing cylinders for gravure printing, comprising the steps of:

acquiring an engraving signal for actuating an engraving stylus of an engraving member from engraving values representing desired tone values and a periodic vibration signal in an engraving amplifier that can be adjusted by signal values for generating an engraving raster;

with the engraving stylus, engraving cells into the printing cylinder, the actual dimensions of the cells representing engraved actual tone values;

calculating transmission functions which reproduce relationships between variations, which are adjusted at the engraving amplifier, of the signal values and resulting variations of the geometric actual dimensions of the engraved cells;

setting signal values for modifying at least one parameter "vibration", "light", "depth", or "medium gradation" at the engraving amplifier;

with the signal values, engraving test cells for predetermined desired tone values, and measuring their geometric actual dimensions;

calculating difference values from the actual dimensions and the desired dimensions of the cells upon consideration of the transmission functions;

correcting the signal values by adding the difference values;

the steps of setting the signal values through correcting the signal values are repeated using the corrected signal values, until the actual dimensions of the cells are at least within a tolerance range about the desired dimensions;

to shorten calibration time,

in each sequence of the steps from setting the signal values through correcting the signal values, comparing the actual dimensions of the cells to the desired dimensions;

if the actual dimensions are outside the tolerance range, recalculating the transmission functions;

computing new difference values upon consideration of the recalculated transmission functions; and

correcting the signal values using the new difference values.

11. The method of claim 10 wherein the recalculation of new transmission functions respectively occurs by difference formation between the adjusted signal values and by difference formation between the functionally corresponding actual dimensions of the cells of two successive sequences from the step of setting the signal values to the step of correcting the signal values.

12. The method of claim 10 wherein the dimension of a cell is a cross-diagonal, a longitudinal diagonal and penetration depth.

13. The method of claim 10 wherein the difference value of the vibration signal value for the parameter "vibration" is computed from a difference between the actual dimensions and the desired dimensions of a test cell representing a tone value domain "depth".

14. The method of claim 10 wherein

a fictional cross-diagonal for a test cell represents the tone value domain "light" as a sum of measured cross-diagonals and a cross-diagonal variation which arises owing to a variation of a vibration signal;

a deviation of the fictional cross-diagonals from desired cross-diagonals is computed; and

a difference value of the engraving signal value for the parameter "light" is computed from the determined deviation and the transmission function which represents the relationship between a variation of the engraving signal value for the parameter "light" and the resulting variation of the cross-diagonals of a test cell representing the tone value domain "light".

15. The method of claim 10 wherein

a fictional cross-diagonal for a cell representing the tone value domain "depth" is determined as a sum of the measured cross-diagonals and a cross-diagonal variation that occurs owing to the variation of the vibration signal;

the deviation of the fictional cross-diagonals from the desired cross-diagonals is determined; and

the difference value of the engraving signal value for the parameter "depth" is computed from the determined deviation and the transmission function, which reproduces a relationship between a variation of the engraving signal value for the parameter "depth" and a resulting variation of the cross-diagonals of a test cell representing the tone value domain "depth".

16. The method of claim 10 wherein

a fictional cross-diagonal for a test cell representing the tone value domain "medium gradation" is computed as a sum of the measured cross-diagonals and cross-diagonal variations that occur owing to the variation of the vibration signal;

a deviation of the fictional cross-diagonals from the desired cross-diagonals is determined, and

a difference value of the engraving signal value for the parameter "medium gradation" is computed from the determined deviation and the transmission function, which reproduces a relationship between a variation of the engraving signal value for the parameter "medium gradation" and the resulting variation of the cross-diagonals of a cell representing a tone value domain "medium gradation".

17. The method of claim 10 wherein

the relationships between signal values and the actual measurements of the engraved test cells are approximately linear; and

the relationships are defined by transmission coefficients.

18. The method of claim 10 wherein the signal values that are set for the first sequence from the step of setting the signal values to the step of correcting the signal values are experimental values.

REMARKS

The specification, drawings, and abstract have been amended in accordance with U. S. practice, and for improved readability and clarity.

A new set of claims are presented drawn in accordance with U. S. practice, and based on the PCT claims as prosecuted in the PCT phase.

An Information Disclosure Statement is enclosed for the Examiner's review.

Respectfully submitted,

(Reg.No. 27,841)

Brett A. Valiquet
Hill & Simpson
A Professional Corporation
85th Floor Sears Tower
Chicago, Illinois 60606
(312) 876-0200; Ext. 3844
Attorneys for Applicants

09/582555

430 Rec'd PCT/PTO 28 JUN 2000

BOX PCT

IN THE UNITED STATES ELECTED OFFICE

OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER THE PATENT COOPERATION TREATY-CHAPTER II

SUBMISSION OF CORRECTED DRAWINGS

APPLICANT: **ERNST-RUDOLF GOTTFRIED WEIDLICH**

DOCKET NO: P00,1316

SERIAL NO: GROUP ART UNIT:

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE99/00052

INTERNATIONAL FILING DATE: 15 January 1999

INVENTION: **"METHOD FOR CALIBRATING AN ENGRAVING AMPLIFIER"**

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Please amend the attached drawing figure as indicated in red in the attached drawing copy.

Respectfully submitted,

[signature] (Reg.No. 27,841

Hill & Simpson
A Professional Corporation
85th Floor Sears Tower
Chicago, Illinois 60606
(312) 876-0200; Ext. 3844
Attorneys for Applicants

0958255 .06/2900

BOX PCT

IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

SECOND PRELIMINARY AMENDMENT

APPLICANT: **ERNST-RUDOLF GOTTFRIED WEIDLICH**

SERIAL NO: 09/582,555 GROUP ART UNIT:
EXAMINER:

FILING DATE: June 28, 2000

INTERNATIONAL APPLICATION NO: PCT/DE99/00052

INTERNATIONAL FILING DATE: 15 January 1999

INVENTION: **"METHOD FOR CALIBRATING AN ENGRAVING AMPLIFIER"**

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

As an additional Preliminary Amendment, the following is submitted:

IN THE SPECIFICATION:

In the first Preliminary Amendment at the material added after line 24, on page 1, in the second line delete "optional" and substitute --optimal--.

In the first Preliminary Amendment after line 25, page 1, at line 18 of the material being added, delete ""depth"" and substitute --"dark"--.

On page 2, at line 9, delete " "depth" " and substitute --"dark"--.

On page 3, at line 16, delete " "depth" " and substitute --"dark"--.

On page 3, at line 21, delete "ridge" and substitute --gutter-, delete "penetration depth" and substitute --channel width--.

On page 3, at line 26, delete " "depth" " and substitute --"dark"--.

On page 5, at line 2, delete " "depth" " and substitute --"dark"--.

On page 5, at line 17, delete " "depth" " and substitute --"dark"--.

On page 6, at line 4, delete " "depth" ".

On page 6, at line 7, delete " "depth" " and substitute --"dark"--.

On page 6, at line 17, delete " "depth" " and substitute --"dark"-- at both occurrences.

On page 6, at line 21, delete "penetration" and substitute --channel--, delete "fetched" and substitute --called--.

On page 6, at line 23, delete " "depth" " and substitute --"dark"--.

On page 7, at line 25, delete "penetration depth" and substitute --channel width--.

On page 7, at line 26, delete " "depth" " and substitute --"dark"--.

On page 8, at line 2, delete " "depth" " and substitute--"dark"--.

On page 8, at lines 15 and 16, delete " "depth" " and substitute --"dark"--.

On page 9, at line 16, delete " "depth" " and substitute --"dark"--.

On page 10, at line 25, delete " "depth" " and substitute --"dark"--.

On page 13, at line 24, delete " "depth" " and substitute --"dark"--.

IN THE CLAIMS:

Please amend claims 10, 12, 13 and 15 as follows:

10.(Amended) A method for calibrating an engraving amplifier in an electronic engraving machine for engraving printing cylinders for gravure printing, comprising the steps of:

acquiring an engraving signal for actuating an engraving stylus of an engraving member from engraving values representing desired tone values and a periodic vibration signal in an engraving amplifier that can be adjusted by signal values for generating an engraving raster;

with the engraving stylus, engraving cells into the printing cylinder, the actual dimensions of the cells representing engraved actual tone values;

calculating transmission functions which reproduce relationships between variations, which are adjusted at the engraving amplifier, of the signal values and resulting variations of the geometric actual dimensions of the engraved cells;

setting signal values for modifying at least one parameter "vibration", "light", ["depth"] "dark", or "medium gradation" at the engraving amplifier;

with the signal values, engraving test cells for predetermined desired tone values, and measuring their geometric actual dimensions;

calculating difference values from the actual dimensions and the desired dimensions of the cells upon consideration of the transmission functions;

correcting the signal values by adding the difference values;

the steps of setting the signal values through correcting the signal values are repeated using the corrected signal values, until the actual dimensions of the cells are at least within a tolerance range about the desired dimensions;

to shorten calibration time,

in each sequence of the steps from setting the signal values through correcting the signal values, comparing the actual dimensions of the cells to the desired dimensions;

if the actual dimensions are outside the tolerance range, recalculating the transmission functions;

computing new difference values upon consideration of the recalculated transmission functions; and

correcting the signal values using the new difference values.

12. (Amended) The method of claim 10 wherein the dimension of a cell is a cross-diagonal, a longitudinal diagonal and [penetration depth] <u>channel width</u>.

13. (Amended) The method of claim 10 wherein the difference value of the vibration signal value for the parameter "vibration" is computed from a difference between the actual dimensions and the desired dimensions of a test cell representing a tone value domain ["depth"] <u>"dark"</u>.

15. (Amended) The method of claim 10 wherein

a fictional cross-diagonal for a cell representing the tone value domain ["depth"] <u>"dark"</u> is determined as a sum of the measured cross-diagonals and a cross-diagonal variation that occurs owing to the variation of the vibration signal;

the deviation of the fictional cross-diagonals from the desired cross-diagonals is determined; and

the difference value of the engraving signal value for the parameter ["depth"] <u>"dark"</u> is computed from the determined deviation and the transmission function, which reproduces a relationship between a variation of the engraving signal value for the parameter ["depth"] <u>"dark"</u> and a resulting variation of the cross-diagonals of a test cell representing the tone value domain ["depth"] <u>"dark"</u>.

REMARKS

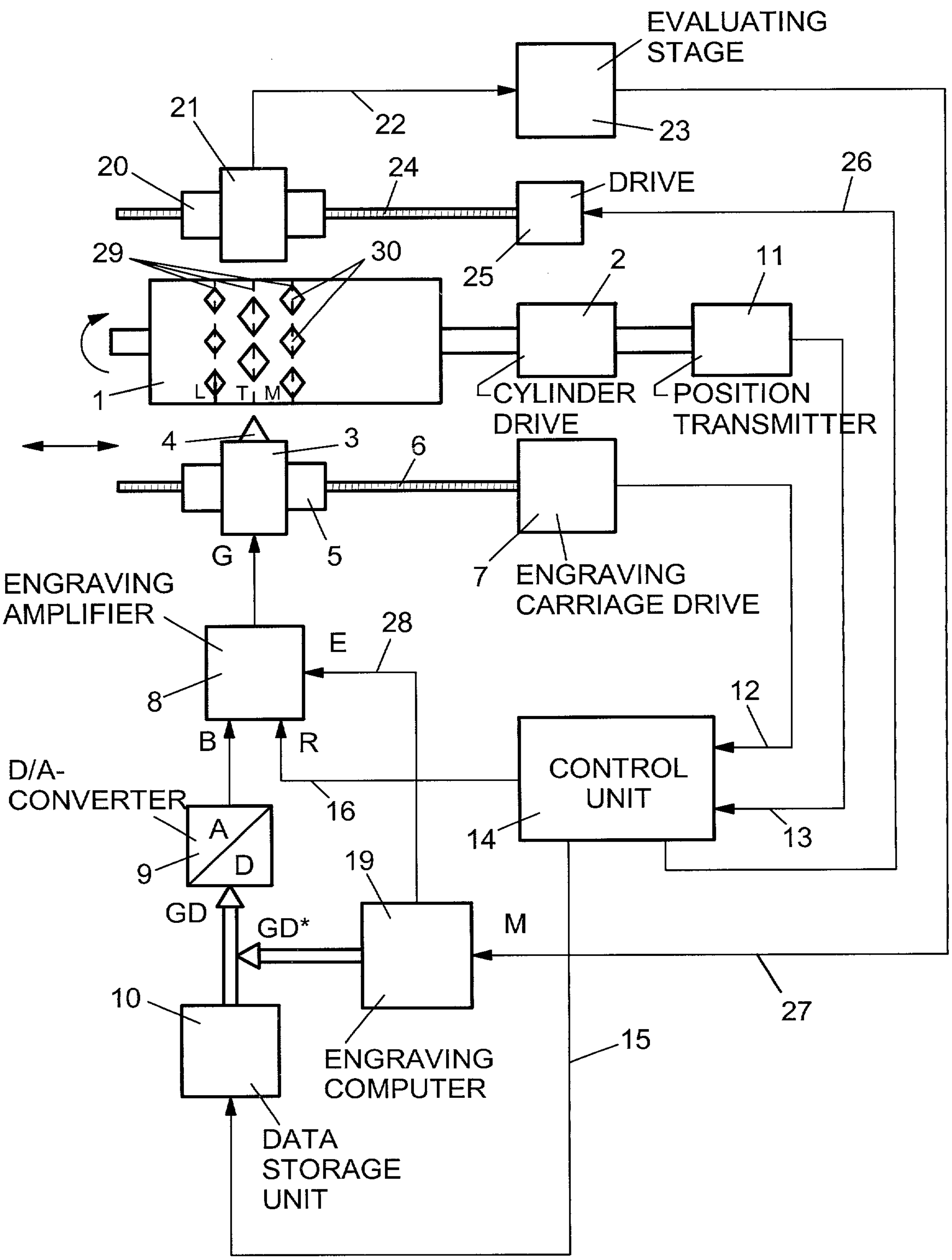
After further review of the PCT specification and translation thereof, and further review of the originally submitted first Preliminary Amendment, certain translation errors were noted which are being corrected herein.

Also please find enclosed the Formal Drawing and the Executed Declaration.

Respectfully submitted,

(Reg.No. 27,841)

Brett A. Valiquet
Schiff Hardin & Waite
Patent Department
6600 Sears Tower
Chicago, Illinois 60606
(312) 258-5500
Attorneys for Applicants


EVALUATING STAGE
21
22
23
20
24
DRIVE
26
29
30
25
2
11
1
L
T
M
CYLINDER DRIVE
POSITION TRANSMITTER
4
3
6
G
5
7
ENGRAVING CARRIAGE DRIVE
ENGRAVING AMPLIFIER
E
28
8
12
B
R
D/A-
CONVERTER
A
D
16
CONTROL UNIT
14
13
9
19
GD
GD*
M
10
27
15
ENGRAVING COMPUTER
DATA STORAGE UNIT

ART 34 AMDT

09/582555

430 Rec'd PCT/PTO 28 JUN 2000

Method For Calibrating an Engraving Amplifier

The invention relates to the field of electronic reproduction technology and relates to a method for calibrating an engraving amplifier in an electronic engraving machine for engraving printing cylinders for gravure printing.

In an electronic engraving machine, an engraving member with an engraving stylus as cutting tool moves at a rotating printing cylinder in the axial direction. The engraving stylus, which is controlled by an engraving signal, cuts a series of cells into the surface of the printing cylinder. The engraving signal is formed in an engraving amplifier by superimposing image signal values with a periodic vibration signal. While the vibration signal effects an oscillating lifting motion of the engraving stylus for the purpose of generating the engraving raster, the image values which represent the tone values between "light" and "dark" which are to be reproduced determine the geometric dimensions of the engraved cells.

So that the cells that are engraved on the printing cylinder have the desired tone values as prescribed by the image signal values, a calibration of the engraving amplifier is performed. To this end, in a test engraving process test cells are engraved for prescribed desired tone values, for instance for the desired tone values "light", "dark" and "middle tone". After the test engraving, the geometric actual dimensions of the engraved test cells are measured out and compared to the corresponding desired dimensions. Settings are calculated from the comparison of the geometric dimensions, with which settings the engraving signal is calibrated such that the geometric dimensions of the cells that are actually created in the engraving correspond to the geometric dimensions required for an engraving with the correct tone values.

In conventional calibration of an engraving amplifier of an engraving machine, the settings are prescribed, the geometric dimensions of the test cells that are engraved in test engravings are measured out, and the new settings are calculated with the aid of the measurement results essentially manually, with the setting processes and subsequent test engravings being continued until an optimal calibration is reached. A disadvantage of the conventional procedure is that the operator must have practical experience concerning the relations between the electrical setting points and the actual geometric dimensions, which are to be expected, of the test cells, whereby numerous parameters and marginal conditions must be accounted for, such as the transmission behavior of the engraving amplifier and the engraving member, the cut angle and the degree of wear of the engraving stylus, as well as the material hardness of the surface of the printing cylinder that is to be engraved.

EP 0 595 324 A already reaches a method for calibrating an engraving amplifier of an engraving machine in which signal values for modifying at least one parameter "vibration", "light", "depth", or "medium gradation" are set at the engraving amplifier, a test engraving is performed using the adjusted signal values, the actual dimensions of the engraved test cells are measured out, and, from the measured actual dimensions and the predetermined desired dimensions, difference values with which the signal values are corrected are calculated upon consideration of previously calculated transmission functions, with the individual steps being repeated in a routine using the respectively corrected signal values until the actual dimensions of the engraved test cells are within a tolerance range.

A similar method for calibrating an engraving amplifier of an engraving machine is known from US 5 438 422 A.

The known methods have the disadvantage that optimal calibration requires a relatively long time, since a new test engraving must always be conducted in the repetitions of the steps.

It is thus the object of the invention to improve a method for calibrating an engraving amplifier in an electronic engraving machine so as to shorten the time required for calibration.

This object is achieved by the features of claim 1.

Advantageous developments and further developments are given in the subclaims.

The invention is detailed below with the aid of the Figure, which represents a principal exemplifying embodiment for an electronic engraving machine for engraving printing cylinders for gravure printing. The engraving machine is a HelioKlischograph® by Hell Gravure Systems GmbH, Kiel, DE.

A printing cylinder (1) is driven to rotate by a cylinder drive (2). The engraving on the printing cylinder (1) is accomplished with the aid of an engraving member (3), which comprises an engraving stylus (4) as cutting tool.

The engraving member (3) is located on an engraving carriage (5), which is moved with the aid of a spindle (6) by an engraving carriage drive (7) in the axial direction of the printing cylinder (1).

The engraving stylus (4) of the engraving member (3) cuts a series of cells that are arranged in an engraving raster line by line into the surface of the rotating printing cylinder (1), while the engraving carriage (5) with the engraving member (3) moves axially along the printing cylinder in the forward direction.

The engraving stylus (4) of the engraving member (3) is controlled by an engraving signal G. The engraving signal G is formed in an engraving amplifier (8) by superimposing a periodic vibration signal R with image signal values B, which represent the tone values between "light" (white) and depth (black) of the cells that are to be engraved. While the periodic vibration signal R effectuates an oscillating lifting motion of the engraving stylus (4) for generating the engraving grid, the image signal values B in connection with the amplitude of the vibration signal R determine the geometric dimensions of the engraved cells such as cross-diagonals, longitudinal diagonals, ridge widths and penetration depth.

The image signal values B are obtained in a D/A converter (9) from engraving data GD, which are stored in an engraving data storage unit (10) and are read out of this line by line and fed to the D/A converter (9). Each engraving location for a cell is assigned an engraving datum in the engraving raster, which contains as engraving information the tone value between the tone values "light' and "depth" that is to be engraved.

The printing cylinder (1) is allocated an XY coordinate system, whose x axis is oriented in the axial direction and whose y axis is oriented in the circumferential direction of the printing cylinder (1). The x spatial coordinates of the engraving locations on the printing cylinder (1) that are arranged in the engraving raster are generated by the engraving carriage drive (7). A position transmitter (11) that is mechanically coupled to the cylinder drive (2) generates the corresponding y spatial coordinates of the engraving locations on the printing cylinder (1). The spatial coordinates (x,y) of the engraving locations are fed to a control unit (14) via lines (12,13).

The control unit (14) controls the addressing and readout of the engraving data GD from the engraving data storage unit (10) as a function of the xy coordinates of the current engraving locations via a line (15). The control unit (14) additionally generates the vibration signal R on a line (16) with the frequency required for generating the engraving raster.

For engraving test cells in a test engraving process that takes place prior to the actual engraving of the printing cylinder (1), the engraving machine comprises a test engraving computer (19), which delivers the required engraving data GD*, which represent the geometric desired dimensions of the test cells that are to be engraved, to the engraving amplifier (8) as digital/analog converted image signal values B.

To pick up a video image of the test cells that are generated in the test engraving process, a measurement carriage (20) that can be displaced in the axial direction of the printing cylinder (1) is provided with a video camera (21), which is connected via a line (22) to an image evaluating stage (23) for measuring out the geometric actual dimensions of the test cells in the video image. The measurement carriage (20) can be moved automatically to the required axial measuring positions via spindle (24) by a measurement carriage drive (25). The measurement carriage (25) is controlled by the control unit (14) by a control command on a line (26).

Alternatively, the video camera (21) can also be arranged in the region of the engraving member (3).

The geometric actual dimensions of the engraved test cells, which are detected in the image evaluation stage (23), are transferred via a line (27) to the test engraving computer (19) as measurement values M. In the test engraving computer (19), electrical settings E for the parameters "vibration", "light", "depth" and "medium gradation" are obtained by comparing the geometric actual dimensions to the predetermined geometric desired dimensions, and these settings are fed to the engraving amplifier (8) via a line (28). With the aid of the electrical setting values E, the vibration signal R and the engraving signal G are so calibrated in the engraving amplifier (8) that cells which are actually generated in the subsequent engraving of the printing cylinder (1) comprise the geometric desired dimensions that are required for an engraving process that is correct in terms of tone values. The calibration can be accomplished manually, but advantageously automatically by a dynamic control process, which can take place before or during the actual production of the printing form.

The inventive calibration with respect to the parameters "vibration", "light', "depth" and "medium gradation" consists of consecutive cycles or runs, where one run consist of the following steps [A] to [F]:

[A] input the electrical settings E_n for the individual parameters "vibration", "light", "depth" and "medium gradation" of a run (n),

[B] perform a test engraving with the inputted settings E_n,

[C] measure out the geometric actual dimensions of the engraved test cells,

[D] compare the geometric actual dimensions to the predetermined desired dimensions,

[E] ready transmission coefficients reproducing the relations between the variations of the electrical signal values and the resulting variations of the geometric dimensions of the engraved cells, and

[F] calculate difference values ΔE from the geometric actual dimensions and the desired dimensions of the engraved test cells and the transmission coefficients, and calculate new settings for the subsequent run (n+1) from the difference values ΔE according to the equation $E_{n+1} = E_n + \Delta E$.

The individual steps [A] to [F] of a run are detailed below.

Step A

In step [A] the electrical settings E_R, E_L, E_T and E_M for the individual parameters "vibration", "light", "depth" and "medium gradation" are inputted into the engraving amplifier (8), whereby the settings E_R control the amplitude of the vibration signal R, the settings E_L and E_T control the engraving signal values G_L and G_T for "light" and "depth", and the settings E_M control the engraving signal value G_M for correcting a medium gradation.

In run I, the settings E_I are generally experimental values; in the subsequent runs (n+1), they are the settings E_{n+1} that are computed in the step [E] of the preceding run (n).

Step [B]

In step [B] a test engraving process is carried out using the settings E_{Rn}, E_{Ln}, E_{Tn} and E_{Mn} that were inputted in step [A]. To generate the test cells, the test engraving computer (19) fetches the engraving data GD* for the desired values "depth", "light", and for at least one "medium gradation" between "light" and "depth", for example. The engraving data GD* represent the predetermined geometric desired dimensions of the test cells, for instance the desired cross-diagonals d'_{QL}, d'_{QT} and d'_{QM} as well as the width d'_k of the penetration or channel in test engravings with penetration. The fetched engraving data GD* are converted into the engraving signal G for the engraving member (3). The engraving member (3) engraves at least one test cell (30) for "light" (L), "depth" (T) and "medium gradation" (M) on adjacent engraving lines (29). Advantageously, several identical test cells (30) are engraved on every engraving line (29), for instance across a selectable engraving line region.

Step [C]

In step [C] the video camera (21) records a video image of the engraved test cells (30) in order to measure out the geometric actual dimensions, namely the cross-diagonals d''_{QL}, d''_{QT}, d''_{QM} and the width d''_{K} of the penetration of the engraved test cells (30) for "light", "depth" and "medium gradation", with the aid of the video image in the image evaluation stage (23) and to route these to the test engraving computer (19) as measurement values M. A method for automatic evaluation of a video image for the purpose of determining the geometric dimensions of test cells is described in depth in WO 98/55302 A (PCT/DE 98/01441).

In Step [D]

In step [D] the geometric actual dimensions d''_{QL}, d''_{QT}, d''_{QM} and d'_{K} and the corresponding geometric desired dimensions d'_{QL}, d'_{QT}, d'_{QM} and d'_{K} are compared to one another, and it is decided with the aid of the comparison result whether another run is necessary for optimizing the calibration, or the calibration can be concluded already. The calibration is concluded either when the measured actual dimensions match the desired dimensions or when the actual dimensions achieved are within a predetermined tolerance range about the predetermined desired dimensions. Instead of the cross-diagonals d''_{QL}, d''_{QT}, d''_{QM} of the cells, their longitudinal diagonals can also be observed.

Step [E]

In step [E] transmission coefficients "f" are made available, which account for the functional relations between the variations of electrical signal values ΔR, ΔG_L, ΔG_T and ΔG_M and the resulting variations of the geometric dimensions

Δd_{QL}, Δd_{QT}, Δd_{QM} and Δd_K of the engraved cells. These functional relations are described below.

A modification of the vibration signal ΔR for calibrating the parameter "vibration" influences the cross-diagonal d_{QT} and the penetration depth d_K of a cell representing the tone value "depth" according to the following relation (I):

$$\Delta(d_{QT}-d_K)=f(R)\times\Delta R \quad \text{(I)}$$

In addition, a modification of the vibration signal ΔR influences the cross-diagonals d_{QL}, d_{QT} and d_{QM} of the cells representing the tone values "light", "depth" and "medium gradation" according to the following relations (II), (III) and (IV):

$$\Delta d_{QL}(R) = f_L(R)\times\Delta R \qquad \text{(II)}$$

$$\Delta d_{QT}(R) = f_T(R)\times\Delta R \qquad \text{(III)}$$

$$\Delta d_{QM}(R) = f_M(R)\times\Delta R \qquad \text{(IV)}$$

A modification of the engraving signal value ΔG_L for calibrating the parameter "light" influences the cross-diagonal d_{QL} of a cell representing the tone value "light" according to the following relation (V):

$$\Delta d_{QL} = 1/f(G_L)\times\Delta G_L \qquad \text{(V)}$$

In addition, a modification of the engraving signal value ΔG_L influences the cross-diagonal d_{QM} of a cell representing the tone value "medium gradation" according to the following relation (VI):

$$\Delta d_{QM}(G_L)=f_M(G_L)\times\Delta G_L \qquad \text{(VI)}$$

Modification of the engraving signal value ΔG_T for calibrating the parameter "depth" influences the cross-diagonal d_{QT} of a cell representing the tone value "depth" according to the following relation (VII):

$$\Delta d_{QT}= 1/f(G_T)\times\Delta G_T \qquad \text{(VII)}$$

In addition, modification of the engraving signal value ΔG_T influences the cross-diagonal d_{QM} of a cell representing the tone value "medium gradation" according to the following relation (VIII):

$$\Delta d_{QM}(G_T) = f_M(G_T)\times\Delta G_T \qquad \text{(VIII)}$$

Correcting the medium gradation corrects the technical wear of the engraving stylus of an engraving member, which manifests itself namely by a reduced cell volume in cells representing a medium gradation. Modification of the engraving signal ΔG_M for medium gradation correction influences the cross-diagonal d_{QM} of a cell representing the medium gradation in accordance with the following relation (IV):

$$\Delta d_{QM} = 1/f(G_M) \times \Delta G_M \qquad \text{(IX)}$$

Under the assumption made in the described exemplifying embodiment that the relations are approximately linear, "f" is a coefficient of transmission, respectively. But in case the functional relations should not be linear, "f" can also be a respective transmission function. The given relations are directly dependent on the type of signal processing. Based on a different signal processing process, the scope of the functional relations can change.

The various coefficients of transmission f in the relations (I) to (IX), which reproduce the overall transmission function of the engraving machine between the electrical settings at the input side and the geometric dimensions of the engraved cells at the output side, are advantageously computed prior to calibration with the aid of test engravings and stored for later use in the test engraving computer (19).

Step [F]

In step [E] **[sic]**, for the subsequent run (n+1) a new vibration signal value R_{n+1} and new engraving signal values G_{Ln+1}, G_{Tn+1} and G_{Mn+1} for the individual parameters "vibration", "light", "depth" and "medium gradation" are calculated.

Parameter "Vibration"

First, upon consideration of relation (I), a difference value ΔR for the vibration signal R is calculated from the measured actual dimensions d''_{QT} and d''_K, the desired dimensions d'_{QT} and d'_K and the transmission coefficient f(R) just calculated, in accordance with equation (X).

$$\Delta R = 1/f(R)[d'_{QT} - d'_K) - (d''_{QT} - d''_K)] \qquad (X)$$

Next, the vibration signal value R_{n+1} for the new run (n+1) is calculated from the difference value ΔR that was calculated according to equation (X) and the vibration signal R_n of the preceding run (n), in accordance with equation (XI).

$$R_{n+1} = R_n + \Delta R \qquad (XI)$$

This vibration signal value R_{n+1} is entered into the engraving amplifier (8) for a new run (n+1) by corresponding setting value E_R.

Parameter "light"

First, a fictive cross-diagonal d^*_{QL} is calculated as the sum of the measured cross-diagonals d''_{QL} and a cross-diagonal variation $\Delta d_{QL}(R)$, which has arisen based on the variation ΔR of the vibration signal according to relation (II), in accordance with equation (XII).

$$d^*_{QL} = d''_{QL} + \Delta d_{QL}(R) \qquad (XII)$$

With the aid of the fictive cross-diagonals d^*_{QL}, it is ascertained how to modify the engraving signal value ΔG_L in order to achieve the desired cross-diagonal d'_{QL}.

To do this, first the deviation Δd_{QL} of the fictive cross-diagonals d^*_{QL} from the desired cross-diagonals d'_{QL} is calculated according to equation (XIII).

$$\Delta d_{QL} = d^*_{QL} - d'_{QL} \qquad (XIII)$$

From the relation (V), the modification of the engraving signal value ΔG_L that is required for the correction of the deviation Δd_{QL} is then calculated upon consideration of the previously calculated transmission coefficient $f(G_L)$, in accordance with equation (XIV).

$$\Delta G_L = f(G_L) \times \Delta d_{QL} \qquad (XIV)$$

Thus the new engraving signal value G_{Ln+1} for the run (n+1) derives in accordance with equation (XV).

$$G_{Ln+1} = G_{Ln} + \Delta G_L \quad (XV)$$

This engraving signal value G_{Ln+1} is entered into the engraving amplifier (8) for a new run by a corresponding setting value E_L.

Parameter "depth"

First, a fictive cross-diagonal d^*_{QT} is calculated as the sum of the measured cross-diagonals d''_{QT} and a cross-diagonal variation $\Delta d_{QT}(R)$, which has arisen based on the variation ΔR of the vibration signal according to relation (III), in accordance with equation (XVI).

$$d^*_{QT} = d''_{QT} + \Delta d_{QT}(R) \qquad (XVI)$$

With the aid of the fictive cross-diagonals d^*_{QT}, it is ascertained how to modify the engraving signal value ΔG_T in order to achieve the desired cross-diagonal d'_{QT}.

To do this, first the deviation Δd_{QT} of the fictive cross-diagonals d^*_{QT} from the desired cross-diagonal d'_{QT} is calculated according to equation (XVII).

$$\Delta d_{QT} = d^*_{QT}-d'_{QT} \qquad (XVII)$$

From the relation (VII), the modification of the engraving signal value ΔG_T that is required for the correction of the deviation Δd_{QT} is then calculated upon consideration of the previously calculated transmission coefficient $f(G_T)$, in accordance with equation (XVIII).

$$\Delta G_T = f(G_T) \times \Delta d_{QT} \qquad (XVIII)$$

Thus the new engraving signal value G_{Ln+1} for the run $(n+1)$ derives in accordance with equation (IXX).

$$G_{Tn+1} = G_{Tn} + \Delta G_T \quad (IXX)$$

This engraving signal value G_{Tn+1} is entered into the engraving amplifier (8) for a new run by a corresponding setting value E_T.

Parameter "medium gradation"

First, a fictive cross-diagonal d^*_{QM} is calculated as the sum of the measured cross-diagonals d''_{QM} and the cross-diagonal variations $\Delta d_{QM}(R)$, $\Delta d_{QM}(G_L)$ and $\Delta d_{QM}(G_T)$, in accordance with equation (XX). The cross-diagonal variations $\Delta d_{QM}(R)$, $\Delta d_{QM}(G_L)$ and $\Delta d_{QM}(G_T)$ arise based on the modification ΔR of the vibration signal R in accordance with the relation (IV) and the variations ΔG_L and ΔG_T of the engraving signal values G, in accordance with the relations (VI) and (VIII).

$$d^*_{QM} = d''_{QM} + \Delta d_{QM}(R) + \Delta d_{QM}(G_L) + \Delta_{QM}(G_T) \qquad \text{(XX)}$$

With the aid of the fictive cross-diagonals d^*_{QM}, it is ascertained how to modify the engraving signal value ΔG_M in order to achieve the desired cross-diagonal d'_{QM}.

To do this, first the deviation Δd_{QM} of the fictive cross-diagonals d^*_{QM} from the desired cross-diagonals d'_{QM} is calculated according to equation (XXI).

$$\Delta d_{QM} = d^*_{QM} - d'_{QM} \qquad \text{(XXI)}$$

From the relation (IV), the modification of the engraving signal ΔG_M that is required for the correction of the deviation Δd_{QM} is then calculated upon consideration of the previously calculated transmission coefficient $f(G_M)$, in accordance with equation (XXII).

$$\Delta G_M = f(G_M) \times \Delta d_{QM} \qquad \text{(XXII)}$$

Thus the new engraving signal value G_{Mn+1} for the run $(n+1)$ derives in accordance with equation (XXIII):

$$G_{Mn+1} = G_{Mn} + \Delta G_M \qquad \text{(XXIII)}$$

This engraving signal value G_{Mn+1} is entered into the engraving amplifier (8) for a new run by a corresponding setting value E_M.

The individual runs are repeated while maintaining the transmission coefficients f until it is ascertained either that the measured actual dimensions match the desired dimensions or that the actual dimensions achieved are within a predetermined tolerance range about the predetermined desired dimensions.

In order to reduce the number of individual runs and thus achieve a more rapid calibration, it is suggested as an advantageous development to determine the differences between the desired dimensions d'_{QT}, d'_{QL}, d'_{QM} and d'_{K} and the respectively achieved actual dimensions d''_{QT}, d''_{QL}, d''_{QM} and d''_{K} in step [D], at least within one run (n), preferably within the second run II, and, if the differences is **[sic]** greater than a predetermined tolerance range below the desired dimensions, to compute improved transmission coefficients f' in step [E] in the sense of a more rapid approximating of the desired dimensions by the actual dimensions, and then in step [F] to calculate a corrected vibration signal value R_{n+1} and corrected engraving signal values G_{Ln+1}, G_{Tn+1} and G_{Mn+1} for the subsequent run (n+1) with the aid of the new transmission coefficients f′, in order to achieve a fast calibration. The improved transmission coefficients f′can be stored and used advantageously for a later calibration prior to the engraving of a new printing cylinder (1).

The determining of the improved transmission coefficients f′, which reproduce relations between the adjusted electrical settings E_n (R_n, G_{Ln}, G_{Tn}, G_{Mn}) and the measured geometric dimensions d''_n(d''_{QL}, d''_{QT}, d''_{QM}, d''_{K}), is accomplished by difference formation between the settings E_n and E_{n+1} and by difference formation between the measured geometric dimensions d_n and d_{n+1} of two consecutive runs (n) and (n+1) by the following general schema:

run n:	setting E_n	$\Rightarrow f \Rightarrow$	measured dimensions d''_n
run (n+1):	setting E_{n+1}	$\Rightarrow f \Rightarrow$	measured deviations d''_{n+1}
Difference formation:	$\Delta(E_n - E_{n+1})$	$\Rightarrow f' \Rightarrow$	$\Delta(d''_n - d''_{n+1})$

The calculation of an improved transmission coefficient f′ is described further in the example of the parameter "vibration".

A first vibration signal value R_I which is entered in the first run I yields the geometric dimensions d_{QTI} and d_{KI} in the first measurement. A second vibration signal value R_{II} which is entered in the second run II yields the geometric dimensions d_{QTII} and d_{KII} in the second measurement. Upon difference formation, the improved transmission coefficient f′ for the parameter "vibration" can be calculated in accordance with equation (XIV), given known ΔR and known geometric dimensions:

$$\Delta R = (R_{II} - R_{I}) = f'[(d''_{QTII} - d''_{QTI}) - (d''_{KII} - d''_{KI})] \qquad \text{(XIV)}$$

Improved transmission coefficients f′ are determined analogously for the other parameters "light", "depth", and "medium gradation".

Patent Claims

1. Method for calibrating an engraving amplifier in an electronic engraving machine for engraving printing cylinders, in which

a) an engraving signal (G) for actuating an engraving member (3) is acquired from engraving values (GD) representing desired tone values and a periodic vibration signal (R) in an engraving amplifier (8) that can be adjusted by signal values (R,G);

b) the engraving member (3) engraves cells into the printing cylinder, the actual dimensions of which cells represent engraved actual tone values;

c) transmission functions (f) are calculated, which reproduce the relations between variations, which are adjusted at the engraving amplifier (8), of the signal values (R, G) and the resulting variations of the geometric actual dimensions of the engraved cells;

d) signal values (R, G_L, G_T, G_M) for modifying at least one parameter "vibration", "light", "depth", or "medium gradation" are set at the engraving amplifier (8);

e) with the signal values (R, G_L, G_T, G_M), cells (33) are engraved for predetermined desired tone values, and their geometric actual dimensions are measured out;

f) difference values (ΔR, ΔG_L, ΔG_T, ΔG_M) are calculated from the actual dimensions and the desired dimensions of the cells (33) upon consideration of the transmission functions (f);

g) the signal values (R, G_L, G_T, G_M) are corrected by adding the difference values (ΔR, ΔG_L, ΔG_T, ΔG_M);

h) the sequences d) to g) are repeated using the corrected signal values (R, G_L, G_T, G_M), respectively, until the actual dimensions of the cells (33) are at least within a tolerance range about the desired dimensions, <u>characterized in that</u> to shorten the calibration time

i) in each sequence d) to g), the actual dimensions of the cells (33) are compared to the desired dimensions;

j) if the actual dimensions are outside the tolerance range, the transmission functions (f) are recalculated, and

k) the difference values (ΔR, ΔG_L, ΔG_T, ΔG_M) are computed upon consideration of the recalculated transmission functions (f′); and

l) the signal values (R, G_L; G_T, G_M) are corrected using the new difference values (ΔR, ΔG_L, ΔG_T, ΔG_M).

2. Method as claimed in claim 1, <u>characterized in that</u> the calculation of the new transmission functions (f′) respectively occurs by difference formation between the adjusted signal values (R, G_L, G_T, G_M) and by difference formation between the functionally appertaining actual dimensions of the cells (33) of two successive sequences d) to g).

3. Method as claimed in claim 1 or 2 <u>characterized in that</u> the dimension of a cell (33) is the cross-diagonals (d_Q), the longitudinal diagonal (d_L) and potentially the penetration depth (d_K).

4. Method as claimed in at least one of the claims 1 to 3, <u>characterized in that</u> the difference value (ΔR) of the vibration signal value (R) for the parameter "vibration" is computed from the difference between the actual dimensions (d''_{QT}, d''_K) and the desired dimensions (d'_{QT}, d'_K) of a cell representing the tone value domain "depth".

5. Method as claimed in at least one of the claims 1 to 4, <u>characterized in that</u>

– a fictive cross-diagonal (d^*_{QL}) for a cell representing the tone value domain "light" **[...]** as the sum of the measured cross-diagonals (d''_{QL}) and a cross-diagonal variation ($\Delta d_{QL}(R)$) which arises owing to the variation (ΔR) of the vibration signal (R),

– the deviation (Δd_{QL}) of the fictive cross-diagonals (d^*_{QL}) from the desired cross-diagonals (d'_{QL}) is computed, and

– the difference value (ΔG_L) of the engraving signal value (G_L) for the parameter "light" is computed from the determined deviation (Δd_{QL}) and the transmission function [$f(G_L)$; $f'(G_L)$] which represents the relation between a variation of the engraving signal value (G_L) for the parameter "light" and the resulting variation of the cross-diagonals (d_{QL}) of a cell (33) representing the tone value domain "light".

6. Method as claimed in at least one of the claims 1 to 5, <u>characterized in that</u>
– a fictive cross-diagonal (d^*_{QT}) for a cell representing the tone value domain "depth" **[...]** as sum of the measured cross-diagonals (d''_{QT}) and a cross-diagonal variation ($\Delta d_{QT}(R)$) that occurs owing to the variation (ΔR) of the vibration signal (R),
– the deviation (Δd_{QT}) of the fictive cross-diagonals (d^*_{QT}) from the desired cross-diagonals (d'_{QT}) is determined, and
– the difference value (ΔG_T) of the engraving signal value (G_T) for the parameter "depth" is computed from the determined deviation (Δd_{QT}) and the transmission function [$f(G_T)$; $f'(G_T)$], which reproduces the relation between a variation of the engraving signal value (G_T) for the parameter "depth" and the resulting variation of the cross-diagonals (d_{QT}) of a cell (33) representing the tone value domain "depth".

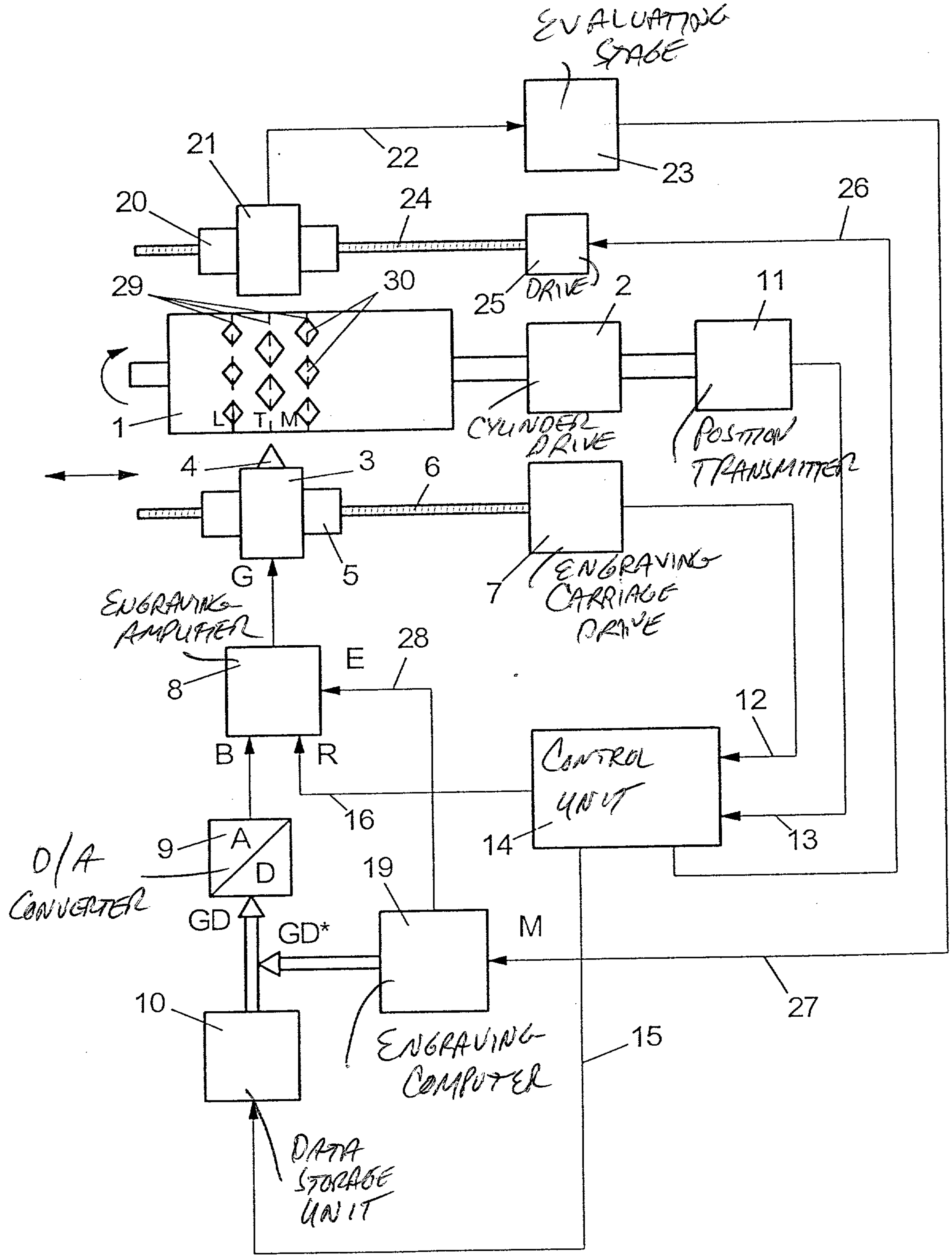
7. Method as claimed in at least one of the claims 1 to 6, <u>characterized in that</u>
– a fictive cross-diagonal (d^*_{QM}) for a cell representing the tone value domain "medium gradation" **[...]** as sum of the measured cross-diagonals (d''_{QM}) and cross-diagonal variations ($\Delta d_{QM}(R)$; $\Delta d_{QM}(G_L)$ $\Delta d_{QM}(G_T)$) that occur owing to the variation (ΔR) of the vibration signal (R),
– the deviation (Δd_{QM}) of the fictive cross-diagonals (d^*_{QM}) from the desired cross-diagonals (d'_{QM}) is determined, and
– the difference value (ΔG_M) of the engraving signal value (G_M) for the parameter "medium gradation" is computed from the determined deviation (Δd_{QM}) and the transmission function [$f(G_M)$ $f'(G_M)$], which reproduces the relation between a

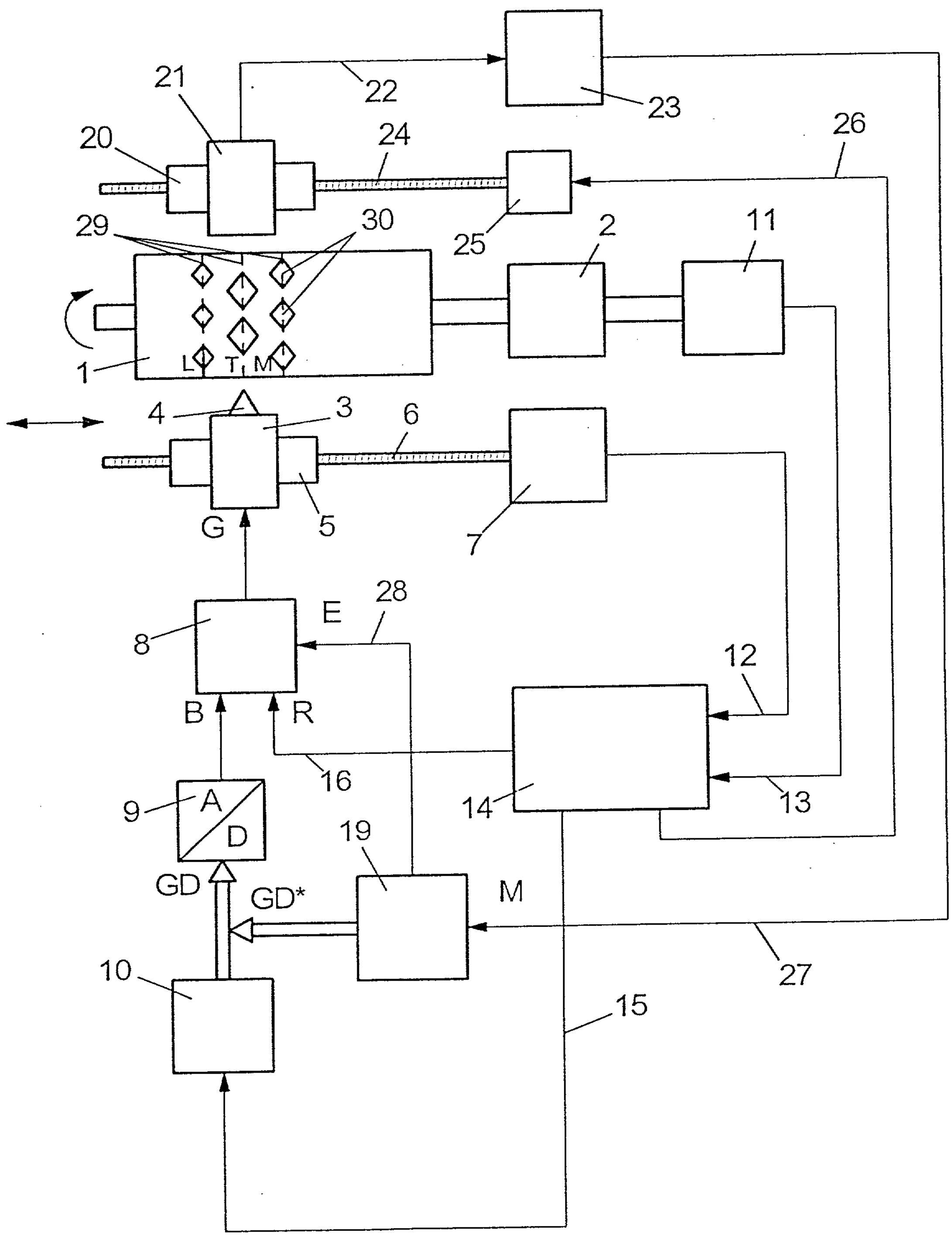
variation of the engraving signal value (G_M) for the parameter "medium gradation" and the resulting variation of the cross-diagonals (d_{QM}) of a cell (33) representing the tone value domain "medium gradation".

8. Method as claimed in at least one of the claims 1 to 7, characterized in that
– the relations between signal values (R, G_L, G_T, G_M) and the actual measurements of the engraved cells (33) are approximately linear, and
– the relations are defined by transmission coefficients (f; f′)

9. Method as claimed in at least one of the claims 1 to 8, characterized in that the signal values (R, G_L, G_T, G_M) that are set for the first sequence d) to g) are experimental values.

09/582555


EVALUATING STAGE
21
22
23
20
24
26
29
30
25
DRIVE
2
11
1
L
T
M
CYLINDER DRIVE
POSITION TRANSMITTER
4
3
6
G
5
7
ENGRAVING CARRIAGE DRIVE
ENGRAVING AMPLIFIER
28
E
8
12
B
R
CONTROL UNIT
16
13
14
9
A
D
D/A CONVERTER
19
GD
GD*
M
10
27
15
ENGRAVING COMPUTER
DATA STORAGE UNIT


21
22
23
20
24
26
29
30
25
2
11
1
L
T
M
4
3
6
G
5
7
28
E
8
12
B
R
16
9
A
D
14
13
19
GD
GD*
M
10
27
15

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Applications) PCT/DE99/00052	ATTORNEY'S DOCKET NUMBER P00,1316

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

"METHOD FOR CALIBRATING AN ENGRAVING AMPLIFIER"

the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application
Serial No. ______________________

on ______________________,

and was amended

on ______________________(if applicable).

☒ was filed as PCT international application

Number **PCT/DE99/00052**

on **15 January 1999**,

and was amended under PCT Article 19

on ______________________(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
GERMANY	**198 01 472.4**	**16 January 1998**	■ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO

Combined Declaration For Patent Application and Power of Attorney (Continued)

(Includes Reference to PCT International Applications) PCT/DE99/00052

ATTORNEY'S DOCKET NO. P00,1316

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject mater of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, Untied States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			

POWER OF ATTORNEY: As a named inventor, I hereby appoint Messrs. John D. Simpson (Registration No. 19,842)), Dennis A. Gross (24,410), Robert M. Barrett, (30,142) Steven H. Noll (28,982), Kevin W. Guynn (29,927), Robert M. Ward (26,517), Brett A. Valiquet (27,841), Edward A. Lehman (22,312), David R. Metzger (32,919), Todd S. Parkhurst (26,494), James D. Hobart (24,149), Melvin A. Robinson (31,870), John R. Garrett (27,888), Joseph P. Reagen (35,332), Michael R. Hull (35,902), Michael S. Leonard (37,557), William E. Vaughan (39,056), and Lewis T. Steadman (17,074), all members of the firm of Hill & Simpson, A Professional Corporation

Send Correspondence to:

HILL & SIMPSON
A Professional Corporation
85th Floor Sears Tower, Chicago, Illinois 60606

Direct Telephone Calls to:

312/876-0200
Ext. 3844

1-00 201	FULL NAME OF INVENTOR	FAMILY NAME **Weidlich**	FIRST GIVEN NAME **Ermst-Rudolf**	SECOND GIVEN NAME **Gottfried**
	RESIDENCE & CITIZENSHIP	CITY **Kiel** DEX	STATE OR FOREIGN COUNTRY **GERMANY**	COUNTRY OF CITIZENSHIP **GERMANY**
	POST OFFICE ADDRESS	POST OFFICE ADDRESS **Fliegender Holländer 29**	CITY **24159 Kiel**	STATE & ZIP CODE/COUNTRY **GERMANY**
202	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
203	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201 Ernst-Rudolf Gottfried Weidlich	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 4.7.00	DATE	DATE